

REMARKS

Claims 1-56 are pending in this application. Claims 57-68 were previously withdrawn. Applicants reserve the right to pursue the original claims and other claims in this application and in other applications.

Claims 1-8, 11, 13-24, 27, 29-43, 46, and 48-56 stand rejected under 35 U.S.C. § 103 as being unpatentable over Wang et al. (U.S. Patent No. 5,607,874) (“Wang”) in view of Mizuhara et al. (U.S. Patent No. 6,228,438 B1) (“Mizuhara”). This rejection is respectfully traversed.

The claimed invention relates to a method of forming a composite barrier layer between a glass insulating layer and active regions of a memory device to eliminate the diffusion of impurity atoms from the glass insulating layer into the active regions of the device. As such, independent claim 1 recites a “method of forming a composite insulating structure” by *inter alia* “forming an oxide layer over at least said source/drain region . . . by oxidizing an upper surface of said source/drain region using atomic oxygen” and “forming a barrier layer over said oxide layer.”

Independent claim 21 recites a “method for forming a memory cell” by *inter alia* “forming a composite barrier layer over said source/drain regions, said composite barrier layer comprising an oxide layer formed by oxidizing upper surfaces of said source/drain regions using atomic oxygen, and a barrier layer formed over said oxide layer.” Similarly, independent claim 40 recites a “method of preventing the diffusion of atoms from a glass insulating layer in to a source/drain region formed between adjacent gate stacks of a memory device” by *inter alia* “forming a composite barrier layer over said source/drain regions, said composite barrier layer comprising an oxide layer formed by oxidizing upper surfaces of said source/drain regions using atomic oxygen, and a barrier layer formed over said oxide layer.”

Wang relates to “a method for fabricating a T or Y shaped capacitor which has less photolithographic and etch steps than the conventional processes.” (Col. 2, lines 28-31). For this, Wang teaches the formation of several gate stacks over a substrate and of a source and drain region. (Col. 4). Wang also teaches the formation of an oxide layer (col. 5, lines 11-17) and of a barrier layer over source/drain regions. (Col. 5, lines 29-35).

Mizuhara relates to “a semiconductor device that allows the adhesion intensity between an upper insulation film and a lower insulation film to be improved.” (Col. 2, lines 31-34). Mizuhara teaches the formation of “a silicon oxide film 21 by CVD all over the device,” which is a completed MOS transistor. (Col. 4, lines 50-53). Mizuhara then teaches forming an aluminum alloy film over the film 21, forming another silicon oxide film 5 over the aluminum alloy film, forming an organic SOG film on the silicon oxide film 5, and forming another silicon oxide film 8 on the SOG film. (Col. 4, lines 61-67; Col. 5, lines 1-49). According to Mizuhara, the silicon oxide films 5 and 8 can be formed by a number of CVD methods using the reactant gases monosilane and oxygen or TEOS and oxygen. (Col. 4, lines 61-67; Col. 12, lines 51-61).

The subject matter of claims 1-8, 11, 13-24, 27, 29-43, 46, and 48-56 would not have been obvious over Wang in view of Mizuhara. Specifically, the Office Action fails to establish a *prima facie* case of obviousness. Courts have generally recognized that a showing of a *prima facie* case of obviousness necessitates three requirements: (i) some suggestion or motivation, either in the references themselves or in the knowledge of a person of ordinary skill in the art, to modify the reference or combine the reference teachings; (ii) a reasonable expectation of success; and (iii) the prior art references must teach or suggest all claim limitations. See e.g., In re Dembiczak, 175 F.3d 994 (Fed. Cir. 1999); In re Rouffet, 149 F.3d 1350, 1355 (Fed. Cir. 1998); Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc., 75 F.3d 1568, 1573 (Fed. Cir. 1996).

Neither Wang nor Mizuhara, whether considered alone or in combination, teach or suggest the limitations of independent claims 1, 21, and 40. Neither Wang nor

Mizuhara teaches or suggests “forming an oxide layer over at least said source/drain region . . . by oxidizing an upper surface of said source drain region using atomic oxygen,” as independent claim 1 recites. Wang and Mizuhara, whether considered alone or in combination, also fail to teach or suggest “forming a composite barrier layer over said source/drain regions, said composite barrier layer comprising an oxide layer formed by oxidizing upper surfaces of said source/drain regions using atomic oxygen, and a barrier layer formed over said oxide layer,” as independent claims 21 and 40 recite.

As acknowledged by the Office Action, Wang is silent about forming an oxide layer “by oxidizing an upper surface of said source drain region using atomic oxygen,” as independent claim 1 recites. Wang is also silent about forming a composite barrier layer “comprising an oxide layer formed by oxidizing upper surfaces of said source/drain regions using atomic oxygen,” as independent claims 21 and 40 recite.

Mizuhara does not overcome the deficiencies of Wang. Mizuhara teaches *depositing* silicon oxide films 5 and 8 on an aluminum alloy film or an organic SOG film, respectively, by plasma CVD or atmospheric CVD. For plasma CVD, Mizuhara teaches using the reactant gases monosilane and oxygen or TEOS and oxygen, while for atmospheric CVD, Mizuhara teaches using monosilane and oxygen. (Col. 4, lines 61-67; Col. 5, lines 1-49; Col. 5; Figs. 2-4). Accordingly, Mizuhara cannot teach or suggest “forming an oxide layer *over at least said source/drain region . . . by oxidizing an upper surface of said source/drain region* using *atomic oxygen*,” as recited in independent claim 1, much less “forming a composite barrier layer *over said source/drain regions*, said composite barrier layer comprising an oxide layer formed by *oxidizing upper surfaces of said source/drain regions* using *atomic oxygen*, and a barrier layer formed over said oxide layer,” as independent claims 21 and 40 recite (emphasis added).

The Examiner has recited the same rejections and bases therefore in the previous Office Action dated November 20, 2002. The only additional reasoning the Examiner has provided is the Examiner’s own assertion that for plasma CVD “[o]xygen and a silane gas

are entered into a chamber and are converted into a plasma, which gives out atomic oxygen.” (Office Action at 8). Thus, the Examiner concludes that that “[i]t would be reasonable to *assume* that at some point the atomic oxygen would react with the surface of the source/drain region and, to some extent, form an oxide layer on the source/drain region.” (Office Action at 8)(emphasis added).

As noted above, Mizuhara only teaches depositing silicon oxide films 5 and 8 on an aluminum alloy film or an organic SOG film, respectively, by plasma CVD using monosilane and oxygen or TEOS and oxygen. Mizuhara does not provide a teaching or suggestion of a procedure related to the Examiner’s assumption. Therefore, contrary to the Examiner’s assertion, it would not be reasonable to assume that atomic oxygen would, at some point, react with the surface of a source/drain region, or form an oxide layer on the source/drain region to some extent during the plasma CVD process taught by Mizuhara.

Moreover, the Examiner is applying the inherency doctrine to establish a *prima facie* case of obviousness. Inherency, however, is a doctrine applicable to rejections under 35 U.S.C. § 102 and is not a substitute for the elements necessary to establish a *prima facie* case of obviousness. See M.P.E.P. § 706.02; see also *In re Bond*, 910 F.2d 831 (Fed. Cir. 1990). “[W]hen the PTO asserts that there is an explicit or implicit teaching or suggestion in the prior art, it must indicate where such a teaching or suggestion appears in the reference. . . . The mere fact that a certain thing may result from a given set of circumstances is not sufficient [to establish inherency] ‘That which may be inherent is not necessarily known. Obviousness cannot be predicated on what is unknown.’” *In re Rijckaert*, 9 F.3d 1531, 1534 (Fed. Cir. 1993).

The Examiner has not pointed to any reference supporting the Examiner’s assumption. The Examiner has ambiguously asserted only a hypothetical, inadvertent deviation from a process that is not contemplated by Mizuhara as providing the teaching or suggestion that would have motivated those skilled in the art to provide the present invention. The Examiner has not alleged or shown that such a deviation is instructional to

those skilled in the art or even that such a deviation, in fact, occurred. In short, the case of obviousness is deficient in its failure to demonstrate that those skilled in the art would have taken any useful teaching or suggestion, or would have been motivated to provide the present invention based on any of the cited references.

For at least these reasons, the Office Action fails to establish a *prima facie* case of obviousness and withdrawal of the rejection of claims 1-8, 11, 13-24, 27, 29-43, 46, and 48-56 is respectfully requested.

Claims 9, 25, and 44 stand rejected under 35 U.S.C. § 103 as being unpatentable over Wang in view of Mizuhara as applied to claims 1-8, 11, 13-24, 27, 29-43, 46, and 48-56 above, and further in view of Lands et al. (“Lands”)(U.S. Patent No. 3,571,914). This rejection is respectfully traversed.

Lands relates to a “method for stabilizing a semiconductor device against spuriously induced changes in the conductivity characteristics at the surface of the semiconductor.” (Col. 1, lines 58-61). Lands is concerned with the use of a silicon dioxide layer formed by the oxidative decomposition of TEOS, by the pyrolysis of TEOS in an inert atmosphere, by the hydrogen reduction of silanes, or by other similar processes wherein the oxide layer may be uniformly doped by the desired stabilizing agent during formation of the oxide layer and stabilization of the surface of a semiconductor device.” (Col. 3, lines 27-34).

As noted above, neither Wang nor Mizuhara, whether considered alone or in combination, teach or suggest the limitations of independent claims 1, 21, and 40. Similarly, Lands fails to teach or suggest forming an oxide layer “by oxidizing an upper surface of said source drain region using atomic oxygen,” as independent claim 1 recites, much less forming a composite barrier layer “comprising an oxide layer formed by oxidizing upper surfaces of said source/drain regions using atomic oxygen,” as independent claims 21 and 40 recite. For at least these reasons, withdrawal of the rejection of claims 9, 25, and 44 is respectfully requested.

Claims 12, 28, and 47 stand rejected under 35 U.S.C. § 103 as being unpatentable over Wang in view of Mizuhara as applied to claims 1-8, 11, 13-24, 27, 29-43, 46, and 48-56 above, and further in view of Kirimura et al. ("Kirimura")(U.S. Patent No. 6,383,869 B1). This rejection is respectfully traversed.

Kirimura relates to "a thin film forming method and a thin film forming apparatus, in which a deposition gas and a radical material having different dissociation energies are used for forming a thin film." (Col. 2, lines 46-49).

None of Wang, Mizuhara and Kirimura, whether considered alone or in combination, teaches or suggests all limitations of independent claims 1, 21 and 40. Claims 12, 28, and 47 are allowable for at least the reasons stated above for claims 1, 21, and 40 respectively. Withdrawal of the rejection of claims 12, 28, and 47 is respectfully requested.

Claims 10, 26, and 45 stand rejected under 35 U.S.C. § 103 as being unpatentable over Wang in view of Mizuhara as applied to claims 1-8, 11, 13-24, 27, 29-43, 46, and 48-56 above, and further in view of Asahina et al. ("Asahina")(U.S. Patent No. 6,326,287 B1). This rejection is respectfully traversed.

Asahina relates to a method for forming a "semiconductor device using, as a wiring material, a specific aluminum alloy which can be embedded in a through-hole without producing any void or wire breaking, and being highly resistant to electro-migration." (Col. 1, lines 37-41).

None of Wang, Mizuhara and Asahina, whether considered alone or in combination, teaches or suggests all limitations of independent claims 1, 21 and 40. Claims 10, 26, and 45 are allowable for at least the reasons stated above for claims 1, 21 and 40 respectively. Withdrawal of the rejection of claims 10, 26 and 45 is respectfully requested.

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In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

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Respectfully submitted,

By 

Thomas J. D'Amico

Registration No.: 28,371

Gabriela I. Coman

Registration No.: 50,515

DICKSTEIN SHAPIRO MORIN &

OSHINSKY LLP

2101 L Street NW

Washington, DC 20037-1526

(202) 785-9700

Attorneys for Applicants